R. F. WEBBER.

STARTING DEVICE FOR EXPLOSIVE ENGINES.

APPLICATION FILED JULY 3, 1911.

1,160,475.

Patented Nov. 16, 1915.

4 SHEETS—SHEET 1.

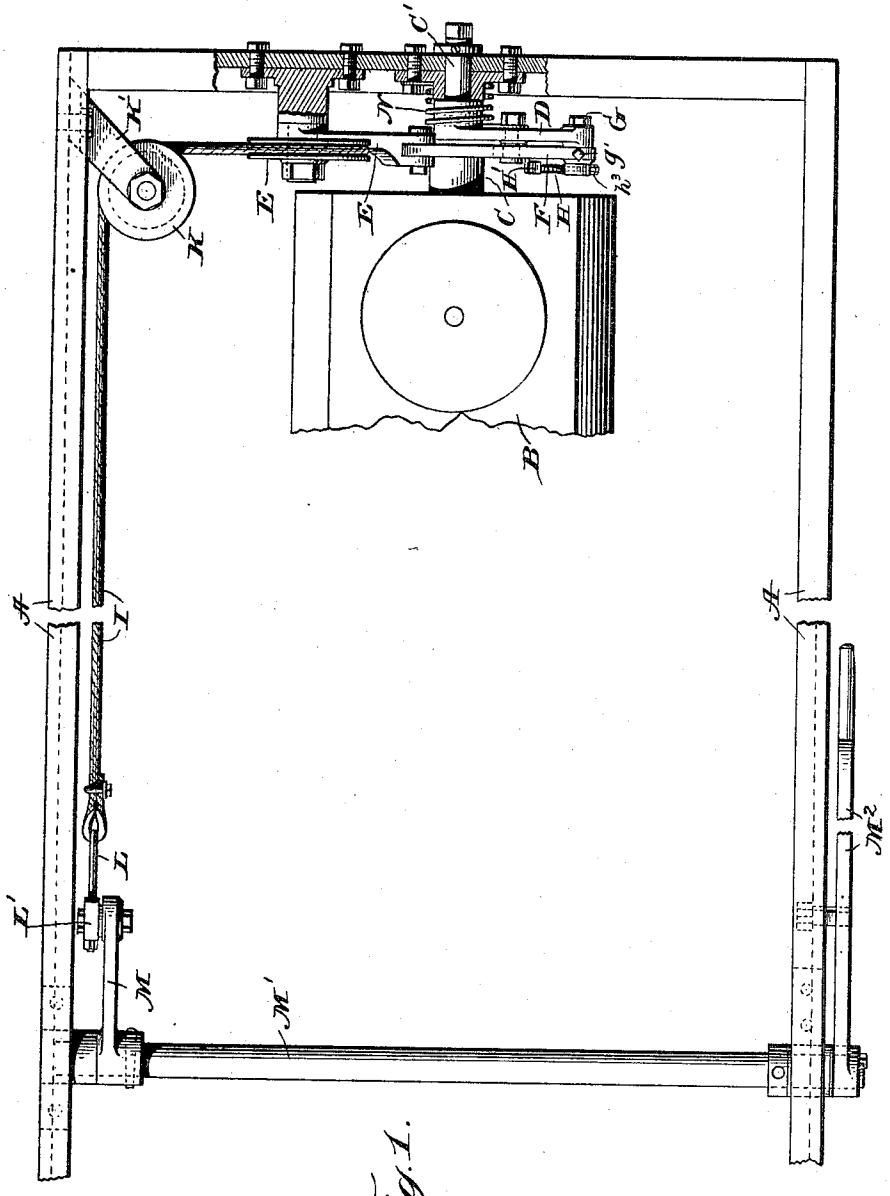


Fig. 1.

Witnesses:

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Thos. C. Straub

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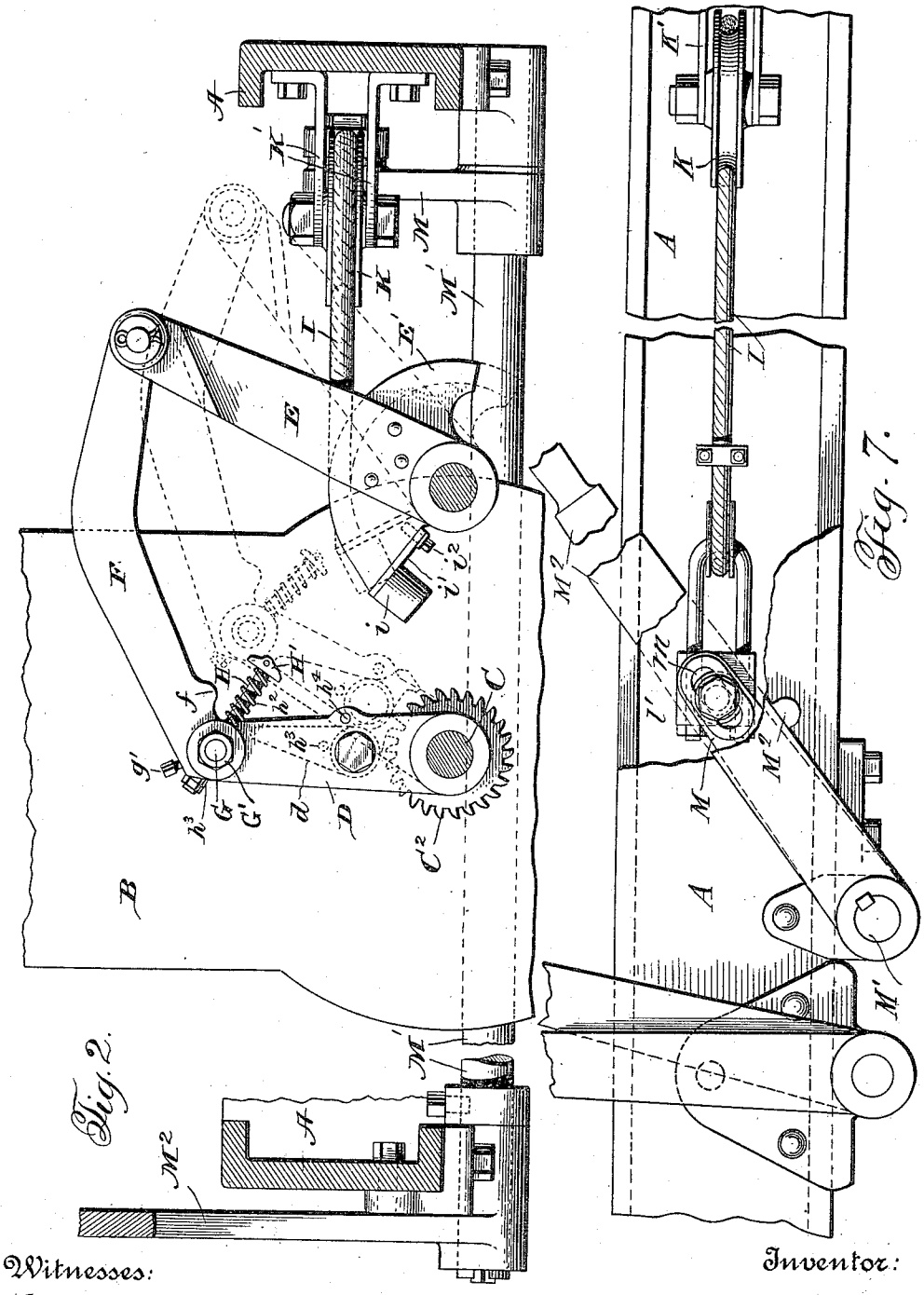


Fig. 2.

Fig. 7.

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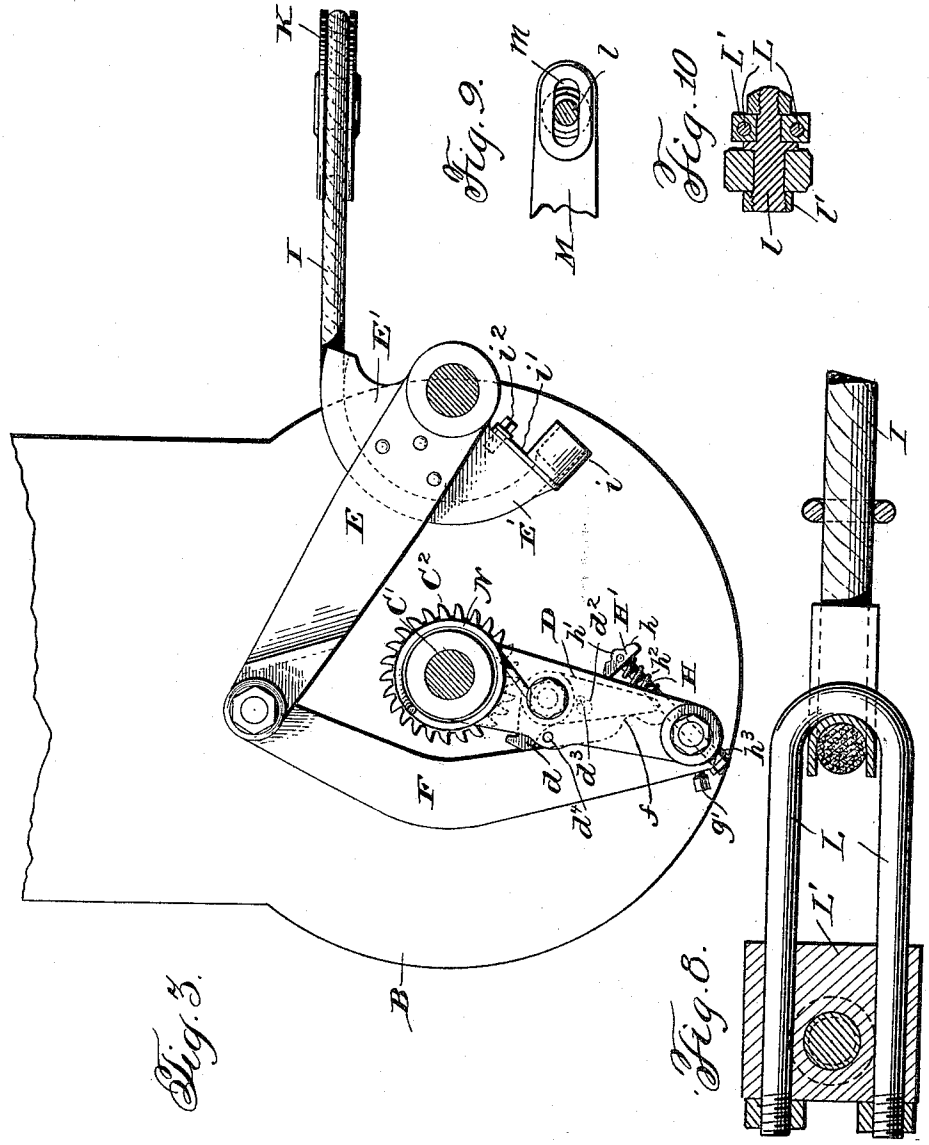
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4 SHEETS—SHEET 3.



Witnesses:

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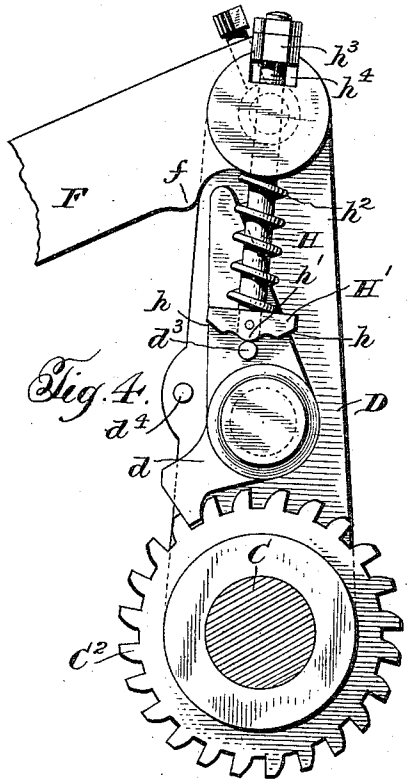


Fig. 4.

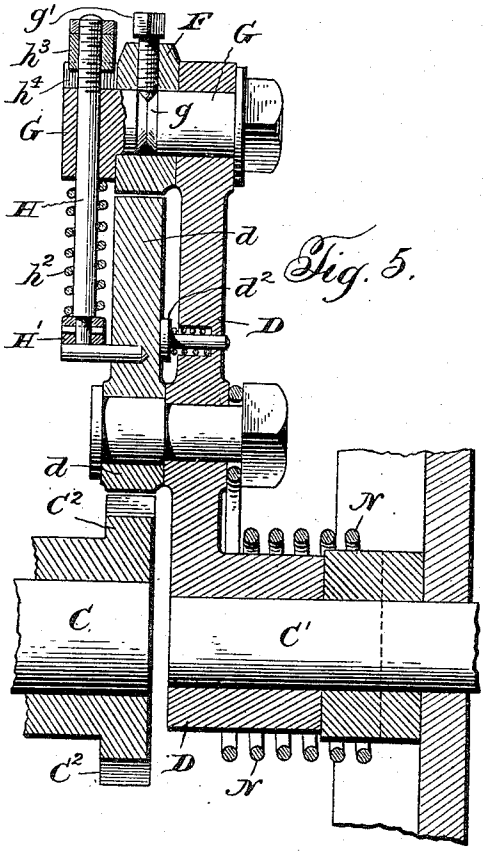
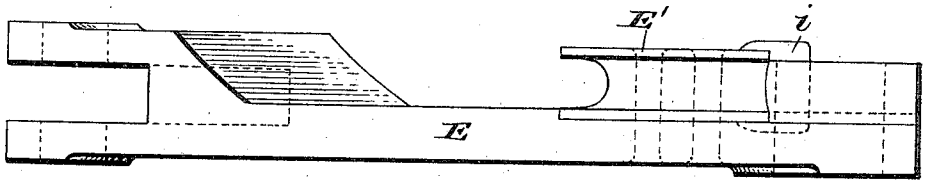


Fig. 5.

Fig. 6.



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UNITED STATES PATENT OFFICE.

ROLLIN F. WEBBER, OF WASHINGTON, DISTRICT OF COLUMBIA.

STARTING DEVICE FOR EXPLOSIVE-ENGINES.

1,160,475. Specification of Letters Patent. Patented Nov. 16, 1915.

Application filed July 3, 1911. Serial No. 636,793.

To all whom it may concern:

Be it known that I, ROLLIN F. WEBBER, citizen of the United States, residing at Washington, District of Columbia, have invented certain new and useful Improvements in Starting Devices for Explosive-Engines, of which the following is a specification, reference being had therein to the accompanying drawing.

This invention relates to improvements in starting devices for explosive engines and more particularly to an improvement to the type of starting device disclosed in the application of Rollin F. Webber and George W. Slater, filed March 19, 1910, Serial Number 550,518.

In the operation of starters of this type, the starting of the motor is effected by the shifting of an arm which is operatively associated with the motor shaft and is provided with a pawl which is adapted to cooperate with a ratchet wheel carried by the engine shaft.

In the application above referred to, means are provided for automatically throwing the pawl to a position to engage the ratchet wheel of the engine shaft at the beginning of the starting operation and means are also provided for automatically disengaging the pawl from its ratchet upon a reverse movement of the motor shaft.

The object of the present invention is the provision of improved means for actuating the pawl to throw the same into and out of operative position.

A further object of the invention is the provision of means for varying the time at which the pawl will be thrown into operative position.

A further object of the present invention is the provision of improved means for actuating the actuating arm of the starter from the operating lever or handle.

Other objects of the invention will be apparent from the detailed description hereinafter when read in connection with the accompanying drawings forming a part hereof, wherein a convenient embodiment of the invention is illustrated, and wherein like characters of reference refer to similar parts of the several views.

In the drawings:—Figure 1 is a top plan view of the improved starting mechanism, parts being shown in section, secured to the frame of a motor vehicle; Fig. 2 is a front elevation of the starting device showing the positions of the parts as the actuating arm nears the end of its movement, the position of the parts when such arm is at the end of the movement being indicated in dotted lines; Fig. 3 is a front elevation, parts being shown in section, of the starting device in normal position; Fig. 4 is a side elevation of the actuating arm showing the pawl carried thereby and means employed for throwing the pawl into and out of engagement with the ratchet wheel of the motor shaft; Fig. 5 is a longitudinal section of the mechanism shown in Fig. 4; Fig. 6 is a side elevation of the operating lever for shifting the actuating arm; Fig. 7 is a side elevation, with parts broken away, showing the hand lever and the cable extending therefrom to the actuating lever; and Figs. 8, 9 and 10 are detailed views illustrating the manner of connecting the cable to the hand lever.

Referring now more particularly to the drawings, A represent the side members of a vehicle frame, B the engine for propelling the vehicle, and C the end of the engine crank shaft to which the engine pistons are connected in the usual well known manner. Journaled in the front portion of the vehicle frame and in alinement with the engine crank shaft C is a stub shaft C′, the outer end of which projects beyond the front portion of the vehicle frame and terminates in a portion which is fashioned for the reception of an ordinary hand crank, should occasion arise for the use of the same. Keyed to the end of the engine crank shaft C is a ratchet wheel C^2 and rigidly mounted upon the stub shaft C′ is an arm D to the inner face of which is pivoted a ratchet or dog *d* which is adapted to coöperate with the ratchet wheel on the engine shaft. The dog or ratchet *d* is in the shape of a bell crank lever, the long arm of which extends upwardly alongside of the arm D. Mounted in the arm D is a spring pressed member d^2 which bears against the rear face of the long arm of the pawl *d*, and serves to retard the movement of such pawl on its pivot. The long arm of the pawl *d* is provided just above the pivotal point of the pawl with a pin d^3 which projects outwardly therefrom, for a purpose to be hereinafter more particularly set forth.

Positioned at one side of the stub shaft C′

hereinbefore referred to and pivotally supported at its lower end to a suitable bracket secured to the front portion of the vehicle frame, is an upstanding lever E which is of greater length than the arm D and the outer end of which is pivotally connected to the outer end of the arm D by means of an elongated downwardly curved link F, which link is of greater length than the distance between the pivot pins of the arm D and lever E. The lever E has secured to its lower end a segment E′ which is provided with a curved periphery for the reception of an actuating cable as will be hereinafter more particularly set forth. The lever E is provided at its upper end with a bifurcated portion in which the end of the link F is pivotally secured and such bifurcated portion is preferably off set from the main portion of the lever in order that the link F will be positioned in substantially the same vertical plane as the segment E′. The link F is pivotally connected to the free end of the arm D by means of a pivot bolt G which passes through alined openings in the link F and arm D and is secured in place by a suitable securing nut G′ which is threaded upon the end of the bolt which projects through the arm D, the head of the bolt being positioned outside of the link F. The portion of the bolt G which passes through the link F has formed therein an annular groove g which is adapted to be engaged by a set screw g' which is threaded in the end of the lever F. By means of the set screw g' above described, the bolt G is rigidly connected to the lever F. Such bolt is free to turn in the arm D. It will also be noted that by this construction the bolt may be adjusted circumferentially in the link F and secured in any desired position of adjustment by means of the set screw g'. Slidably mounted in the head of the bolt G is a rod H which terminates at its end in an elongated foot portion H′, between which foot portion and the head of the bolt is interposed a coil spring h^2 which tends to force the foot portion downwardly. The foot portion H′ is positioned outside of the upwardly extending arm of the pawl d and is positioned in a plane parallel thereto. The foot piece is provided with downwardly inclined surface h at the ends thereof and with a downwardly extending rounded projection h' which is positioned between the inclined surfaces at the ends of the foot portion. Downward movement of the foot portion H′ is limited by means of a nut h^3 which is threaded upon the upper end of the rod H and which normally works within an opening h^4 which is formed in the upper portion of the periphery of the head of the bolt G and which is fashioned to engage the side walls of the nut h^3 so as to prevent rotation of the rod H. If it is desired to adjust the throw of the rod H the same is elevated until the nut h^3 is withdrawn from the recess h^4 in the head of the bolt when such nut can be turned on the rod H to any desired extent.

The upwardly extending arm of the pawl d extends in close proximity to the link F and such link is provided adjacent its connection with the arm D with a projection f which is adapted to contact with the upwardly extending arm of the pawl d after the link has been moved to a certain position relative to the arm D, for a purpose to be hereinafter more particularly set forth.

Movement of the pawl d on its pivot is limited by means of a stop d^4 which projects laterally from the arm D and overlies the nose of the pawl.

Seated in the periphery of the segment E′ carried by the lever E is a cable I, one end of which is anchored in any suitable manner to the ends of the segment. In the drawings I have illustrated a convenient method of anchoring the cable to the segment so that it may be readily removed therefrom when desired. In the construction shown, the end of the cable is anchored in any suitable manner within a socket i which is carried by a plate i' which is adapted to be detachably secured by a suitable fastening bolt i^2 to the end of the segment. The fastening bolt i^2 serves to secure the plate to the end of the segment and movement of such plate about its fastening bolt as a pivot is prevented by the flanges of the periphery on the segment between which the cable, which is anchored to the plate, is positioned. Obviously should it, for any reason, be desired to detach the cable from the segment, it is only necessary to remove the fastening bolt i^2 and thus free the plate i'. The cable I extends from the segment E′ transversely of the frame of the machine and around an idler K which is mounted on a suitable bracket K′ supported in any suitable manner from the frame of the machine, and thence rearwardly of the frame of the machine. The free end of the cable terminates in a loop which engages a U-shape strap L which projects from a block L′ which block is secured to the outer portion of an arm M which is carried by a shaft M′ which is journaled in suitable bearings carried by the side bars of the frame of the machine. The shaft M′ is provided with a suitable operating handle M^2 and the shaft is so positioned in the frame of the machine that such operating handle will be accessible to a person occupying the usual driver's seat.

Means are conveniently employed for adjustably connecting the cable to the arm M in order that the operator may vary the leverage when desired. To this end the arm M is provided with a slot m which is posi-

tioned in the outer end thereof and extends longitudinally of the arm and the block L′ has rigidly secured thereto in any desired manner a laterally extending bolt *l* which is adapted to project through the slot *m* in the arm M. A securing nut *l′* is threaded upon the outer extremity of the bolt *l*. From the construction thus described it will be seen that the block L′ may be rigidly coupled to the frame M at any desired distance from the shaft M′ carrying such arm.

When the starting device is not in use, the actuating arm D, lever E, and link F occupy the position shown in Fig. 3, that is to say, the actuating arm extends downwardly from its supporting shaft, the lever E is inclined so that the outer end thereof will overlie the engine shaft, and the link F occupies a substantially vertical position alongside of the engine shaft. When the parts are in this position it will be noted that the projection *f* of the link F is in engagement with the long arm of the detent or pawl *d* and that such detent or pawl is thus held out of engagement with the teeth of the ratchet wheel of the engine shaft. When the parts are in this position the hand lever M^2 occupies the position shown in Fig. 7, all of the parts being normally held in this position by means of a spring N which is interposed between the arm D and the frame of the machine. With the parts in this position, when it is desired to start the motor, the operator draws upwardly on the hand lever M^2 thus pulling upon the cable I and rocking the lever E on its pivot. As the lever E is thus shifted, the arm D will be moved in a clockwise direction about its supporting shaft. During this movement of the actuating arm about its supporting shaft, the angle between the link F and the actuating arm D will be gradually increased and as the rod H is rigid with the link F, it will be seen that the foot portion H′ thereof will be caused to engage the pin d^3 projecting from the upwardly extending arm of the dog or pawl *d* and to ride thereover. The engagement of the foot portion H′ with the laterally projecting pin of the pawl serves to shift the pawl on its pivot a sufficient distance to cause the nose thereof to engage the teeth of the ratchet wheel on the engine shaft, so that during the remainder of the movement of the actuating arm, the engine shaft will be rotated. The peculiar formation of the foot portion H′ insures the engagement of the dog or pawl *d* with its ratchet wheel at all times, as during the passage of said foot portion over the pin d^3 of the pawl, it delivers to said pin a series of successive blows, the pin first being engaged by the first inclined end portion *h* of the foot portion, next by the central portion *h′* and next by the inclined portion *h* at the opposite end of said foot portion. It will thus be seen that if, when the first engaging surface of the foot portion contacts with the pin projecting laterally from the pawl, and the pawl is shifted thereby, and should fail to properly engage the ratchet wheel by reason of the nose thereto engaging one of the teeth of such wheel, said pawl would be moved into engagement with the ratchet wheel when the pin d^3 thereof was engaged by one of the other contacting surfaces of the foot portion H′. After the pawl has been moved into operative engagement with its ratchet wheel, the foot portion H′ will during the continued movement of the parts, ride out of engagement with the pin d^3 of the pawl, but the pawl will remain in engagement with the ratchet wheel until the engine has been started when it will be moved out of engagement therewith by the contact of the inclined teeth of the ratchet with the nose of the pawl.

As soon as the engine has been started the operator releases his hold upon the hand lever M^2 when the spring N will immediately restore the parts to normal position. During the return of the parts to normal position the foot portion H′ of the pawl actuating member will again ride over the laterally projecting pin d^3 of the pawl or detent *d* and return the same to normal position, such detent having been already disengaged from the teeth of the ratchet by the inclined faces of such teeth during the forward rotation of the engine shaft. Should the engine shaft reverse during the starting operation the pawl will remain in engagement with the ratchet wheel and its position will not be changed as the foot portion H′ of the pawl actuating member rides over the pin d^3 thereof. It is therefore necessary to provide means for shifting the pawl in the event of such occurrence and to this end the link F is provided with the projection *f*, which as the parts approach their normal position, contacts with the long arm of the pawl and serves to positively move the same out of engagement with its ratchet.

By adjusting the bolt G in the link F, the foot portion H′ of the pawl actuating member may be made to engage the ratchet wheel either at the very beginning of the movement of the arm D or at any time thereafter. This feature of adjusting the time of actuating the pawl is an important one as it enables the device to be used in connection with explosive engines of all kinds regardless of the degree of rotation which must be imparted to the engine shaft to start the engine.

While I have illustrated in the accompanying drawings, a convenient embodiment of the invention, it will be understood that many changes may be made to the form and construction therein shown without depart-

ing from the spirit and scope of the invention as defined in the appended claims.

I claim:—

1. A starting device for motors including an actuating part, coupling means for effecting an operative connection between the actuating part and the motor shaft, means on the actuating part for automatically rendering said coupling means operative during movement of the actuating part, and means for adjusting said last mentioned means whereby said coupling is rendered operative at different periods in the movement of the actuating part.

2. A starting device for motors comprising an actuating arm operatively associated with the motor shaft, interlocking members adapted to form a connection between said actuating arm and the shaft, one of said members being movable, and adjustable means for shifting said movable member relative to the actuating arm and into locked engagement with the other during a part of the movement of the actuating arm to rotate the shaft.

3. A starting device for motors, including a pawl and ratchet, an arm carrying the pawl, means for operating said arm including a movable part pivoted thereto, a pawl actuating member carried by said movable part for engaging the pawl, and means for adjusting said pawl actuating member to vary the time of its engagement with the pawl.

4. A starting device for motors including a pawl and ratchet, an arm carrying the pawl, means connected with said arm for operating the same including a part movable relative thereto, a pawl actuating member on said movable part, for throwing the pawl into engagement with the ratchet in the forward movement of the device, and means for adjusting said pawl actuating member to vary the time of actuation of said pawl.

5. A starting device for motors including a pawl and ratchet, an arm carrying the pawl, means connected with said arm for operating the same including a part movable relative thereto, a spring pressed pawl actuating member carried by said movable part and provided with a foot portion adapted to ride over a portion of the pawl.

6. A starting device for motors including a pawl and ratchet, an arm carrying the pawl, means connected with said arm for operating the same including a movable part, a spring pressed pawl actuating member carried by said movable part and provided with a foot portion adapted to ride over a part of the pawl during the actuation of the device, said foot portion being provided with a plurality of contacting surfaces.

7. A starting device for motors, including a pawl and ratchet, an arm carrying the pawl, said pawl being provided with a projection extending laterally therefrom, means connected with said arm for operating the same including a part movable relative thereto, a spring pressed pawl actuating member carried by said movable part and provided at its lower end with a foot portion adapted to ride over the laterally extending projection of the pawl.

8. A starting device for motors including a pawl and ratchet, an arm carrying the pawl, means connected with said arm for operating the same including a part movable relatively thereto, a spring pressed pawl actuating member carried by said part and provided with a foot portion adapted to ride over a portion of the pawl during the actuation of the device, and means for angularly adjusting said pawl actuating member to vary the time of actuation of the pawl.

9. A starting device for motors including a pawl and ratchet, an arm carrying the pawl, means connected with said arm for operating the same including a part movable relative thereto, and an angularly adjustable pawl operating member carried by said movable part and adapted to throw the pawl into engagement with the ratchet in the forward movement of the device.

10. The combination with a motor, of means for starting the same including a pawl and ratchet connection operatively associated with the engine shaft, an arm carrying said pawl, means for operating the arm including a link pivotally connected thereto, a pawl actuating member shiftable with said link and operating in the forward movement of the device to engage the pawl with the ratchet, and in the reverse movement of the device to disengage the pawl from the ratchet, and means for adjusting said pawl actuating member to vary the time of actuation of the pawl.

11. The combination with a motor, of means for starting the same including a pawl and ratchet connection operatively associated with the engine shaft, an arm carrying said pawl, means for operating the arm including a link, means for pivotally connecting said link and arm comprising a pin pivot rigid with said link and loosely mounted in said arm, and means for operating the pawl comprising a spring pressed pawl actuating member slidably mounted in said pivot pin.

12. The combination with a motor, of means for starting the same including a pawl and ratchet connection operatively associated with the engine shaft, an arm carrying said pawl, means for operating said arm including a link, means for pivotally connecting the link to the arm comprising a pivot pin passing therethrough, adjustable means for rigidly coupling the pivot pin to

the link, and means carried by the pivot pin and adapted in the forward movement of the device to engage the pawl with the ratchet and in the reverse movement of the device to disengage the pawl from the ratchet.

13. The combination with a motor, of means for starting the same including a pawl and ratchet connection operatively associated with the engine shaft, an arm carrying said pawl, said pawl being provided with a portion projecting laterally therefrom, means for operating said arm including a link, a pivot pin rigid with said link and loosely engaging said arm, and a spring pressed pawl actuating member slidably mounted in said pivot pin and provided at its lower end with a foot portion adapted to ride over the laterally projecting portion of the pawl during the operation of the device.

14. The combination with a motor, of means for starting the same including a pawl and ratchet connection operatively associated with the engine shaft, an arm carrying said pawl, said pawl being provided with a portion projecting laterally therefrom, means for operating said arm including a link, a pivot pin rigid with said link and loosely engaging said arm, and a spring pressed pawl actuating member slidably mounted in said pivot pin and provided at its lower end with a foot portion adapted to ride over the laterally projecting portion of the pawl during the operation of the device, said foot portion being provided with a plurality of surfaces adapted to successively engage the laterally projecting portion of the pawl as it passes thereover.

15. The combination with a motor, of means for starting the same including a pawl and ratchet connection operatively associated with the motor shaft, an arm carrying said pawl, means for operating the arm including a link, means for pivotally connecting the link to the arm comprising a pivot bolt loosely engaging the link and arm, adjustable means for rigidly coupling the pivot bolt to the link, a spring pressed pawl actuating member slidably mounted in said pivot bolt and provided at its lower end with a foot portion adapted to ride over a part of the pawl during the operation of the device.

16. The combination with a motor, of means for starting the same including a pawl and ratchet connection operatively associated with the engine shaft, an arm carrying said pawl, means for operating the arm including a link, means for pivotally connecting the link to the arm comprising a pivot bolt rigid with said link and loosely engaging said arm, said pivot bolt being provided with a transverse opening through one end thereof, a rod slidably mounted in said opening and provided at its lower end with a foot portion adapted to ride over a part of the pawl during the operation of the device, a spring interposed between said foot portion and the head of the bolt, and a nut adjustably secured upon the free end of said rod.

17. The combination with a motor, of means for starting the same, including a pawl and ratchet connection operatively associated with the engine shaft, an arm carrying said pawl, means for operating the arm including a link, means for pivotally connecting the link to said arm comprising a pivot bolt rigid with said link and loosely engaging said arm, said pivot bolt being provided with a recess in the periphery of the head thereof and said bolt having an opening extending transversely through the head thereof and opening into the said recess, a rod slidably mounted in the opening in the head of the bolt and provided at its lower end with a foot portion adapted to ride over a portion of the pawl during the operation of the device, a spring interposed between said foot portion and the head of the starting means and a nut adjustable on the free end of said rod and normally fitting within the recess in the periphery of the head of the bolt.

18. A starting device for motors, comprising an arm operatively associated with the motor shaft, an operating lever, a pivoted link connection between said lever and arm, a pawl and ratchet connection between the arm and motor shaft, and a longitudinally yieldable pawl actuating member carried by said link and movable therewith, said pawl actuating member being provided with a foot portion adapted to engage and ride over a portion of the pawl during the operation of the device.

19. A starting device for motors comprising an arm operatively associated with the motor shaft, an operating lever, a pivoted link connection between said lever and arm, a pawl and ratchet connection between the arm and the motor shaft, and a yieldable pawl actuating member carried by the pivoted link and movable therewith, said pawl actuating member having a foot portion provided with a plurality of contact surfaces adapted to successively engage and ride over a portion of the pawl during the operation of the device.

20. A starting device for motors comprising an arm operatively associated with the motor shaft, an operating lever, a pivoted link connection between said lever and arm, a pawl and ratchet connection between the arm and the motor shaft, a pawl actuating member carried by said link and movable therewith to throw the pawl into and out of engagement with the ratchet, when

the operating lever is shifted, and means for adjusting said pawl actuating member to vary the time of actuation of the pawl.

21. A starting device for motors comprising an arm operatively associated with the motor shaft, a ratchet wheel on the motor shaft, a pawl carried by said arm and adapted to coöperate with said ratchet wheel, said pawl being provided with a member projecting laterally therefrom, an operating lever, a link pivotally connecting said operating lever and said arm, a longitudinally yieldable pawl actuating member carried by said link and movable therewith, said pawl actuating member being provided at its lower end with a foot portion adapted to engage and ride over the member projecting from the pawl, and means for adjusting said pawl actuating member longitudinally.

22. A starting device for motors comprising an arm operatively associated with the motor shaft, a ratchet wheel on the motor shaft, a pawl carried by said arm and adapted to coöperate with said ratchet wheel, said pawl being provided with a member projecting laterally therefrom, an operating lever, a link pivotally connecting said operating lever and said arm, a longitudinally yieldable pawl actuating member carried by said link and movable therewith, said pawl actuating member being provided at its lower end with a foot portion adapted to engage and ride over the member projecting from the pawl, means for adjusting said pawl actuating member longitudinally, and means for adjusting said pawl actuating member angularly relative to said link.

23. A starting device for motors comprising an arm operatively associated with the motor shaft, a ratchet wheel on the motor shaft, a pawl carried by said arm, means for actuating said arm, and means acting automatically upon the actuation of said arm for successively engaging said pawl to throw the same into engagement with its ratchet.

24. The combination with a motor, of means for starting the same comprising an arm operatively associated with the motor shaft, a lever, a link connection between the ends of said lever and said arm, a segment carried by said lever, a cable overlying said segment and secured to one end thereof, means for actuating said cable to shift said lever, and means for returning the parts to normal position.

25. The combination with a motor, of means for starting the same comprising an arm operatively associated with the motor shaft, a lever, a link connection between the ends of said lever and said arm, a grooved segment carried by said lever, a cable overlying the periphery of said segment and anchored to one end thereof, a hand lever connected to the other end of said cable, and means for holding the parts in normal position.

26. The combination with a motor, of means for starting the same comprising an arm operatively associated with the motor shaft, a lever positioned at one side of the motor shaft, a link connecting the free ends of said lever and said arm, a segment carried by said lever, a cable overlying the periphery of said segment and having one end anchored thereto, a hand lever, and an adjustable connection between the other end of said cable and said hand lever.

27. The combination with a motor, of means for starting the same comprising an arm operatively associated with the motor shaft, a lever, a link connection between the free ends of the lever and said arm, a segment carried by said lever, a cable overlying the periphery of said segment and having one end thereof anchored thereto, an operating shaft, an arm extending from said operating shaft, and means for adjustably securing the other end of said cable to said arm.

28. The combination with a motor, of means for starting the same including an actuating part, means for coupling the actuating part and the motor shaft, means for automatically rendering such coupling operative during movement of the actuating part, and means for adjusting said last mentioned means to vary the time when the coupling between the actuating part and the motor shaft is rendered operative.

In testimony whereof I affix my signature in presence of two witnesses.

ROLLIN F. WEBBER.

Witnesses:
JAS. E. HUTCHINSON,
CALVIN T. MILANS.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."